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CURRICULUM GUIDE

Senior High School

CURRICULUM GUIDE

for

MATHEMATICS

(1954 Edition)

Mathematics 10
Mathematics 20
Mathematics 30
Mathematics 11
Mathematics 21
Mathematics 12
Mathematics 22

Province of Alberta

Department of Education

September, 1954

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FOREWORD

This curriculum guide is an interim edition for the school year 1954-55 only, containing details of the following revised mathematics courses in the senior high school:

Mathematics 10
Mathematics 20
Mathematics 30
Mathematics 11
Mathematics 21
Mathematics 12
Mathematics 22

For Mathematics 32, teachers may continue to use the outlines for General Mathematics 3 (Bulletin 4) during the school year 1954-55.

INTRODUCTION

In the preparation of this Guide, the Curriculum Branch of the Department of Education has the following convictions:

1. Mathematics is valuable and important in the modern world and therefore all students entering high school have need for more mathematical training.

2. Greater efficiency in the teaching and learning of mathematics is a natural outcome of a thorough understanding of its vocational and cultural uses.

3. It is essential that the teacher of secondary mathematics understand the part his subject plays in the entire secondary program.

Concerning the importance of mathematics in the modern world, the report of the Joint Commission of the Mathematical Association of America and the National Council of Teachers of Mathematics states:

> The paramount mathematical need of the average citizen is for a greater knowledge of arithmetic than is now common. By arithmetic is meant more than computational facility and understanding of principles. There is needed also familiarity with applications to a wide variety of problems or situations that confront people, and ability to understand certain mathematical ideas and procedures that may be encountered in ordinary reading.*

In the 1950 revised edition of the Encyclopedia of Educational Research, an article on Secondary Mathematics (page 717) contains the following paragraph:

> The impact of World War II brought to light a very marked deficiency in mathematics among the inductees into the war-training program. The situation became so acute that the United States Office of Education, in conjunction with the National Council of Teachers of Mathematics, appointed two committees to study the problem and make recommendations concerning what the schools should do to meet the emergency.

These committees published two reports which indicated:

1. A need for a more functional program of mathematical instruction in our schools.

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*Appendix 1, Fifteenth Yearbook of the National Council of Teachers of Mathematics.

2. A continuation of arithmetical experience for the high school student.

It would seem that, during high school, students should be given an opportunity to prepare themselves for greater participation in economic and social affairs. Given an opportunity, they show interest in activities such as buying, selling, investing, budgeting, insuring, and paying of interest and taxes. These activities are part of the experience of most people; indeed, everyone is very much concerned.

SUGGESTIONS TO THE MATHEMATICS TEACHER

1. In no other subject on the high school program is correctness and accuracy in language more important than in mathematics. Students' statements, whether oral or written, should be complete, concise, and in conformity with the principles of good English. Furthermore, special care should be taken to ensure that students understand thoroughly, spell correctly, and use accurately the vocabulary peculiar to mathematics.

2. It is not recommended that students be required to do all the problems contained in the authorized textbooks. Roughly one-half to two-thirds of the problems in most of the sets should prove adequate. Those chosen should, of course, be sufficiently representative to ensure mastery of the principles which they exemplify.

3. Early in the term, high standards of neatness and accuracy in computational work should be established and subsequently maintained.

4. The use of tables of powers, roots, logarithms, trigonometric functions, etc., should be encouraged whenever the opportunity presents itself. FOUR-FIGURE MATHEMATICAL TABLES, by Knott, will be found very satisfactory, and may be obtained from the School-Book Branch. These are the tables provided for the use of students writing departmental examinations in Grade XII mathematics.

5. Inventory, diagnostic and achievement tests are of particular value in mathematics, and teachers are urged to use them frequently.

6. Teachers' comments respecting any of the courses and textbooks will be welcomed by the Curriculum Branch.

OBJECTIVES OF SENIOR HIGH SCHOOL MATHEMATICS

1. To contribute through mathematics to the general aims of education.

2. To develop powers of clear understanding and logical thinking.

3. To encourage the habit of critical thinking and to develop intellectual honesty.

4. To make mathematics act as a guide to intelligent economic living and social adjustment.

5. To develop appreciation of the contributions of mathematics to the progress of civilization.

6. To develop and maintain numerical computational skills and processes.

7. To demonstrate the role of mathematics in the development of occupational skills.

8. To develop a sense of satisfaction from accomplishment and a sense of personal responsibility for accuracy, neatness, and precision.

MATHEMATICS 10

Text: MATHEMATICS FOR CANADIANS, BOOK 2, Bowers, Miller and Rourke.

Content:

A. Geometry:

1. Review material: Chapter IV.

2. New material: Chapters V to XIV inclusive.

B. Algebra:

1. Review material: Chapters I and III.

2. New material: Chapters II, XVII and XVIII. (Omit pages 373 to 379, dealing with incomplete squares, the sum and difference of cubes, and the factor theorem.)

C. Arithmetic: Chapter XV.

N.B.: Chapter XVI on numerical trigonometry is no longer required.

NOTE: As this text is a continuation of the one now in use in Grade IX, teachers of this course will be well advised to familiarize themselves with Book I. The material of Chapters I, III and IV is in the nature of review work, and may therefore be omitted in whole or in part depending on the needs of the class.

Comments:

A. Geometry

The study of geometry should contribute in two ways to the intellectual development of the pupil:

1. It should supply him with a body of interesting information which is applicable to innumerable practical situations.

2. It should provide him with training in critical thinking and logical reasoning which can be carried over into non-mathematical fields.

In addition, a well-taught course in geometry should develop in the pupil:

1. desirable habits of work: neatness, accuracy, concentration, organization, self-reliance.

2. desirable traits of character: good judgment, ability to face facts, independent thinking, persistence, reliability.

In its factual aspect it is the purpose of the course to familiarize the pupil with:

1. the elementary geometrical concepts and definitions.

2. the basic theorems regarding congruence, isosceles triangles, parallelism, ratio, proportion, areas and the theorem of Pythagoras.

3. the methods of constructing bisectors, perpendiculars, angles, triangles, and parallel lines.

4. acceptable methods of computation.

5. the use of formulae for areas and volumes.

In the field of logical reasoning it is the objective of the course to ensure that the pupil has the ability to:

1. recognize and formulate the assumptions underlying an argument.

2. define precisely the terms requiring definition.

3. organize statements in a coherent, logical sequence.

4. draw correct conclusions.

5. recognize and determine the validity of converse statements. In this connection note particularly Chapters V and XIII.

B. Algebra

It is expected that on completion of this section of the course the pupil will show improvement in:

1. precision in the use of language.

2. interpretation and solution of simple problems.

3. proficiency in the following algebraic skills:

   (a) manipulation of signed numbers, use of parentheses, combining similar terms.

   (b) substitution, changing the subject of a formula.

(c) solving simple linear equations, systems of linear equations, quadratic equations (by factoring), equations involving fractions.

(d) multiplication and division of polynomial expressions.

(e) reading, interpreting and constructing statistical graphs.

(f) understanding the relationship of variable quantities, and constructing graphs of linear equations.

(g) factoring expressions involving common factors, differences of squares, and trinomials of the type $ax^2 + bx + c$.

(h) applying the fundamental operations to fractions.

C. Arithmetic

It is suggested that this part of the course be treated in as practical a manner as possible. For example, the topic of Income Tax should be dealt with by using current income tax forms.

For the section on Life Insurance an excellent reference is LIFE INSURANCE - A CANADIAN HANDBOOK.

MATHEMATICS 20

Texts: MATHEMATICS FOR CANADIANS, BOOK 3, Bowers, Miller and Rourke.

Pamphlet: LOCUS AND THE CIRCLE.

Special Note to Principals, Counselors and Teachers:

Since a "B" standing in Mathematics 20 will be prerequisite to Mathematics 30 in Grade XII, only students who have obtained a "B" standing in Mathematics 10 should be advised to proceed to Mathematics 20.

Content

A. Algebra: Chapters I to X, inclusive, of MATHEMATICS FOR CANADIANS, BOOK 3, omitting pages 61-67, "Ratios Used in Trigonometry".

Note: Chapters XI, XII and XIII of this text are omitted from the Mathematics 20 course.

B. Geometry: Locus and the Circle, as in pamphlet, but omitting pages 392-402 and related exercises. It is suggested that in planning the year's work teachers reserve up to six weeks' teaching time for the geometry section.

Suggestion:

The text and the pamphlet contain a wealth of practice exercises from which teachers should make a selection suited to the needs of their classes. In general, the "C" exercises at the end of a chapter are intended only as enrichment problems for outstanding students of mathematics.

MATHEMATICS 30

Texts: AN ADVANCED COURSE IN ALGEBRA, Miller and Rourke.

MATHEMATICS FOR CANADIANS, BOOK 3, Chapter XII (available in booklet form).

PLANE TRIGONOMETRY AND ANALYTIC GEOMETRY, Sprague, Chapters I, II and III.

Outline of Course

The detailed course outline and suggested order of topics for Mathematics 30 is as follows. Except where otherwise noted, Chapter references are to AN ADVANCED COURSE IN ALGEBRA.

Chapters I, II and III of PLANE TRIGONOMETRY AND ANALYTIC GEOMETRY, by Sprague; i.e., Logarithms, Trigonometric Functions, and solution of the Right Triangle.

Chapter XII of MATHEMATICS FOR CANADIANS, BOOK 3, pages 260-267.

Chapter I: Functions.

Chapter II: The Linear Function and Applications.
Omit Section 10 and related exercises.

Chapter III: Quadratic Functions and Quadratic Equations.
Omit Section 23 and related exercises.

Chapter IV: Polynomials and Algebraic Equations.
Omit Sections 28, 29, 30, 31, 32 and 33 and related exercises.
Omit Parts B and C of Exercises on the Chapter, pages 123-128.

Chapter XII of MATHEMATICS FOR CANADIANS, BOOK 3, pages 268-291.

Chapter VI: Series of Numbers: The Progressions.
Omit Sections 45, 47.1, 50 and 51, and related exercises.

Chapter VII: Permutations and Combinations.
Omit Sections 62 and 63, and related exercises.

Chapter IX: The Binomial Theorem.
Omit Section 69 and related exercises.

Special Notes

1. Chapters V, VIII and X of AN ADVANCED COURSE IN ALGEBRA are not on the course.

2. The text contains abundant exercise material classified under headings A, B, and C. In general, all classes will do Exercise A; most classes will attempt some of Exercise B; only the most advanced classes or individual students will work in Exercise C.

3. Knott's MATHEMATICAL TABLES is authorized for use in Mathematics 30.

4. Teachers may use either method of expressing the characteristic of a logarithm of a number less than one:

   (a) One method always provides for a positive characteristic, by use of a "10" to be subtracted at the end of a logarithm.

   (b) The other method provides for a negative characteristic to be shown as $\bar{1}$ or $\bar{2}$, etc.

MATHEMATICS 11

Text: BUSINESS ARITHMETIC, Currie and Piper (Unabridged).

Note: A course outline has not as yet been prepared for this subject. It is intended that teachers will select the content most suitable to their particular class. The entire textbook need not be covered. This course is intended primarily for students who are taking a Commercial pattern or for students who do not intend to proceed to University matriculation.

MATHEMATICS 21

Text: MATHEMATICS FOR THE CONSUMER, Schorling, Clark and Lankford.

Note: As MATHEMATICS FOR THE CONSUMER contains considerable data applicable to the American way of life, this book has been authorized temporarily. If teachers' reactions to the textbook are favorable, and if the number of students taking the course is large enough, steps will be taken to secure a Canadian edition.

Scope of the Course:

Statistics, Purchasing, Credit, Budgets, Investments, Insurance and Taxation.

Suggestions for Teachers of Mathematics 21:

1. It is advisable for every teacher of this course to read "Mathematical Foundations for the Consumer", which begins on page iii of the text. The last paragraph on page vi is particularly important.

2. It is necessary that teachers of this course should perform two functions:

   (a) To lead pupils to a realization of the objectives of mathematics.

   (b) To contribute to achievement of the objectives of general education.

3. It is essential for teachers of mathematics to evaluate instruction, keeping in mind the four major functions below:

   (a) Measuring the achievement of objectives.

   (b) Providing data for pupil guidance.

(c) Diagnosing student strengths and weaknesses.

(d) Comparing different teaching techniques.

4. The teacher should feel free to modify the order of topics in accordance with the needs of his class. For example, the material contained in the section entitled "Computation Workshop" might well be assigned to students at various times throughout the year.

References:

A list of reference books which are suitable for each unit will be included in the final revision of this outline. In the meantime, each teacher should make use of any reference books which may be found in the school library.

Outline for Mathematics 21:

UNIT ONE: How to Handle Statistics

Some objectives which might be kept in mind:

1. To train pupils to understand and use elementary statistical terms.

2. To promote understanding of assumptions, conclusions, and the nature of proof.

3. To develop the student's power of communication.

UNIT TWO: Better Buymanship

In addition to studying topics included in Unit Two, consideration might be given to problems such as the following:

1. What factors should be kept in mind when buying or building a home?

2. What circumstances justify buying an automobile before buying a home?

UNIT THREE: Using Consumer Credit

Note: The derivation of the formulas $\frac{2hl}{n(f+1)}$ and

$r = \frac{2ml}{B(n+1)}$ on page 153 and 157 respectively

may be omitted.

Other features which may be considered are:

1. What rate of interest does one pay to a Canadian bank if principal is borrowed with:
   (a) bonds as collateral,
   (b) property as collateral,
   (c) insurance as collateral,
   and so on?

2. What rate of interest does one pay if money is borrowed from local finance companies?

UNIT FOUR: At Home and On the Job

A unit on the budget of high school students may have the following objectives:

1. To give a student practical guidance in managing his own budget.

2. To make comparisons between various types of budget (family, personal, and small business).

3. To acquaint students with use and interpretation of graphs; for example:

   (a) expenditures - budgeted and expended.

   (b) savings and income from one month to another.

UNIT FIVE: Investments

In addition to material which appears in Unit Five, other topics which will help to enrich the student's knowledge may be discussed; for example:

1. Why buy bonds or stocks which satisfy the "Guides for Investors" (listed on pages 246-248)?

   Outcomes which might be considered are:

   (a) To inform the student about the securities issued by the various governments (municipal, federal and provincial).

   (b) To create and foster the habit of thrift in every pupil.

   (c) To awaken a personal interest in the financial policies of governments.

   (d) To make a student realize that he will play a vital part in the development of his country's resources and services.

UNIT SIX: Greater Security

Reference: LIFE INSURANCE - A CANADIAN HANDBOOK

In addition, it is suggested that the students be encouraged to:

1. Determine the types of insurance available from insurance agents and offices in the community.

2. Investigate the reasons for the higher premiums for people driving automobiles.

3. Make a comparative study of American and Canadian plans for social security, opportunities for employment, employment offices, pension schemes, etc.

UNIT SEVEN: Taxation

The factual material in this unit is of limited value to the Canadian student. Canadian forms of taxation should be studied in some detail and comparison made with the material in the textbook.

Suggestions:

1. Review and study the purposes and sources of municipal, provincial, and federal taxes.

2. Calculate various types of taxes (property and income taxes).

MATHEMATICS 12

Text: NEW VOCATIONAL MATHEMATICS, Dooley and Kriegel.

Content:

1. Fundamental Operations: addition, subtraction, multiplication, division.
2. Arithmetic factoring, highest common factor, least common multiple, cancellation, etc.
3. Vulgar, decimal and percentage fractions.
4. Ratio and Proportion: direct, inverse and compound.
5. Powers and Roots - confined to squares and cubes.
6. Knott's Tables for powers and roots.
7. Use of Symbols: arithmetic and algebraic: addition, subtraction, multiplication, division and brackets.
8. Positive and negative quantities.
9. Fundamental operations in algebra.
10. Simple equations and problems involving one variable. Transposition, removal of brackets, manipulation of formulas.
11. Simple Factoring (common factor, factor by grouping, difference of squares).
12. Simultaneous equations of 1st degree: simple examples and problems.
13. Lines (perimeters of common geometric figures).
14. Areas (rectangles, parallelograms, trapesiums, circles, prisms).
15. Volumes (rectangular solids).

Notes:

1. This course is designed as a first course in mathematics, in preparation for entrance to a Technical Institute or apprenticeship to a trade.
2. The content of the course should be covered as Mathematics 12 is a prerequisite to Mathematics 22.
3. Knott's MATHEMATICAL TABLES are recommended for use in the course.

MATHEMATICS 22

Text: NEW VOCATIONAL MATHEMATICS, Dooley and Kriegel.

Content:

1. Review and drill on fundamental operations: Topics 1, 2, 3, 4, and 5 of Mathematics 12.

2. Review of introductory algebra: Topics 7, 8 and 9 of Mathematics 12.

3. Logarithms - using Knott's Tables.

4. Review of Factoring: Topic 11 of Mathematics 12.

5. Review of Simultaneous Equations: Topic 12 of Mathematics 12.

6. Factoring a trinomial.

7. Quadratic Equations.

8. Lines: circle: radius, diameter, circumference, arc.

9. Areas: circle, surface of spheres, cylinders, prisms, frustra of cones and pyramids.

10. Volumes: spheres, cylinders, prisms, frustra of cones and pyramids.

11. Powers and roots: positive, negative and fractional exponents; zero exponent; roots mostly rational.

12. Trigonometry:

    (a) angles: positive and negative; systems of measurement.

    (b) trigonometric functions: definitions; values from figures and tables.

    (c) solution of right triangles.

    (d) problems dealing with heights and distances; angles of elevation and depression.

13. Graphs:

    (a) graphs of 1st degree functions.

    (b) graphs of 2nd degree functions related to formulas.

    (c) graphs of simple trigonometric functions.

Notes:

1. Mathematics 12 is a prerequisite for this course.

2. It is felt that this course will meet the requirements of students preparing for entry into a Technical Institute or a trade better than the matriculation courses of Mathematics 10 and Mathematics 20.

3. Knott's MATHEMATICAL TABLES are recommended for use in the course.

GENERAL REFERENCES FOR TEACHERS OF MATHEMATICS

THE PLACE OF MATHEMATICS IN SECONDARY EDUCATION (Fifteenth Yearbook of the National Council of Teachers of Mathematics)

ARITHMETIC IN GENERAL EDUCATION (Sixteenth Yearbook of the National Council of Teachers of Mathematics)

GENERAL EDUCATION IN A FREE SOCIETY (Harvard University Press)

MATHEMATICS FOR THE MILLION (Lancelot Hogben)

THE TEACHING OF SECONDARY MATHEMATICS, Butler and Wren

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